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ABSTRACT

Presented is another document in the Technical Report series produced at the Science Education Center of the University of Iowa. This publication emphasizes curriculum evaluation. Material is presented in three sections: an introductory section in which the components of curriculum are identified and described; a second section in which these components (objectives, learning experiences, organization of learning experiences, evaluation of student progress) are discussed in some detail; and a final section, focused on curriculum development. An eight-item bibliography is also included. (PEB)

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Some Considerations in the Development, Implementation and Evaluation of Curricula

by

David Cohen

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SOME CONSIDERATIONS IN THE DEVELOPMENT, IMPLEMENTATION AND EVALUATION OF CURRICULA

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INTRODUCTION

Curriculum means different things to different people. In terms of the daily pressures upon teachers, curriculum may be regarded as something to keep students busy and quiet, often degenerating into learning the contents of the textbook. From the student viewpoint, it may be perceived as a set of unrelated lessons separated by room-changing routines with the opporutnity to talk to friends. As viewed by the school administrator, it may be the means of providing students with opportunities to prepare for batteries of standardized tests which show the school standards are high - or maybe the principal sees curriculum as the means of keeping the school quiet and orderly. Such concerns represent vital aspects of school life. However, none of these perceptions accord with the view of the curriculum as the vehicle for the overall educational development of individual students. It is the purpose of this paper to clarify some of the issues related to curriculum. In particular, the meaning of "curriculum", some problems related to the implementation of new curricula, and some procedures for stimulating curriculum change will be explored.

Curriculum theorists have wrestled with the problem of providing a common definition of curriculum which may be equally acceptable to various groups, including teachers and other educators, and various shades of psychologists. Many writers in the field, e.g. Tayler (1950), Taba (1962), have stated or implied that curriculum may be represented by a sequential model, as below in Figure 1.

Specification of Objectives ⟶ Learning Experiences ⟶ Organization of Learning Experiences ⟶ Evaluation of Student Progress

Figure 1. Sequential Model of Curriculum Development

The model is based upon four components or elements of curriculum. For convenience and simplification, the model treats these as distinct phases or stages in the development, implementation, and evaluation of curricula. As a matter of convenience, these components will now be considered separately and in turn.

Components of Curriculum

(a) Objectives. Statements of objectives are intended to reflect the intentions for the curriculum. The statements may be couched in terms of what the teacher intends to do, or what it is hoped the learner may accomplish (learner outcomes). The development of educational objectives represents a subjective activity, producing an expression of value judgments concernin the purposes of education (See also Cohen and Simpson, 1974). To be considered adequately, an in-depth evaluation of a complete spectrum of alternatives is required as well as the selection and ordering of priorities. In terms of what happens in schools, the objectives help to guide not only which activities should be developed, but also the relative duration of these activities. Individual teachers may have clearly-perceived sets of objectives for themselves and their students. Many educators would argue teachers should have such sets of objectives. Certainly, many teachers learn to verbalize sets of objectives as a requirement within their teacher education programs. Words like cognitive/affective/psychomotor domains, and performance/behavioral/specific objectives become part of the verbal repertoire of most beginning teachers. But, to be meaningful and to affect what teachers do in their daily interactions with students, objectives must be internalized as integral parts of the personal belief systems and philosophies of the teachers. This

takes time and reflection. The mature teacher might reach the stage where the reasons for any student activities could be given in terms of educational objectives. Perhaps the emergence of objectives might only be expected to occur following a fairly substantial incubation period during which teachers develop and modify their beliefs about life and the roles of schools in particular, and educ[illegible]n in general, within life.

Indeed, there are many aspects to be considered if objectives are to be thoughtfully derived. Considerations drawn from philosophy (What is "good" for the students?), sociology (How socially relevant are the objectives?), and psychology (What is my group of learners like? How can learning procedures best be matched to them?) have been regarded as basic (c.f., Tyler, 1950). Objectives may be influenced by pressure groups, with motives "good" and "bad". Examples of the concerns of pressure groups include environmental issues and the promotion of vested interests. Objectives may be distorted in undesirable ways by the imposition of external examinations. The availability of research findings about such things as the "teachability" of certain topics, about effective methods for translating objectives into classroom procedures, and about teacher effectiveness each has implications also for the selection or modification of objectives. Depicted schematically, the derivation of objectives might be represented as in Figure 2. The deceptiveness of such a mechanistic model must be recognized. For example, the model fails to account for the negotiations and tensions of the people involved in the processes of deliberation about the objectives. Yet, decisions must be reached from the complex kaleidoscope of ideas and values.

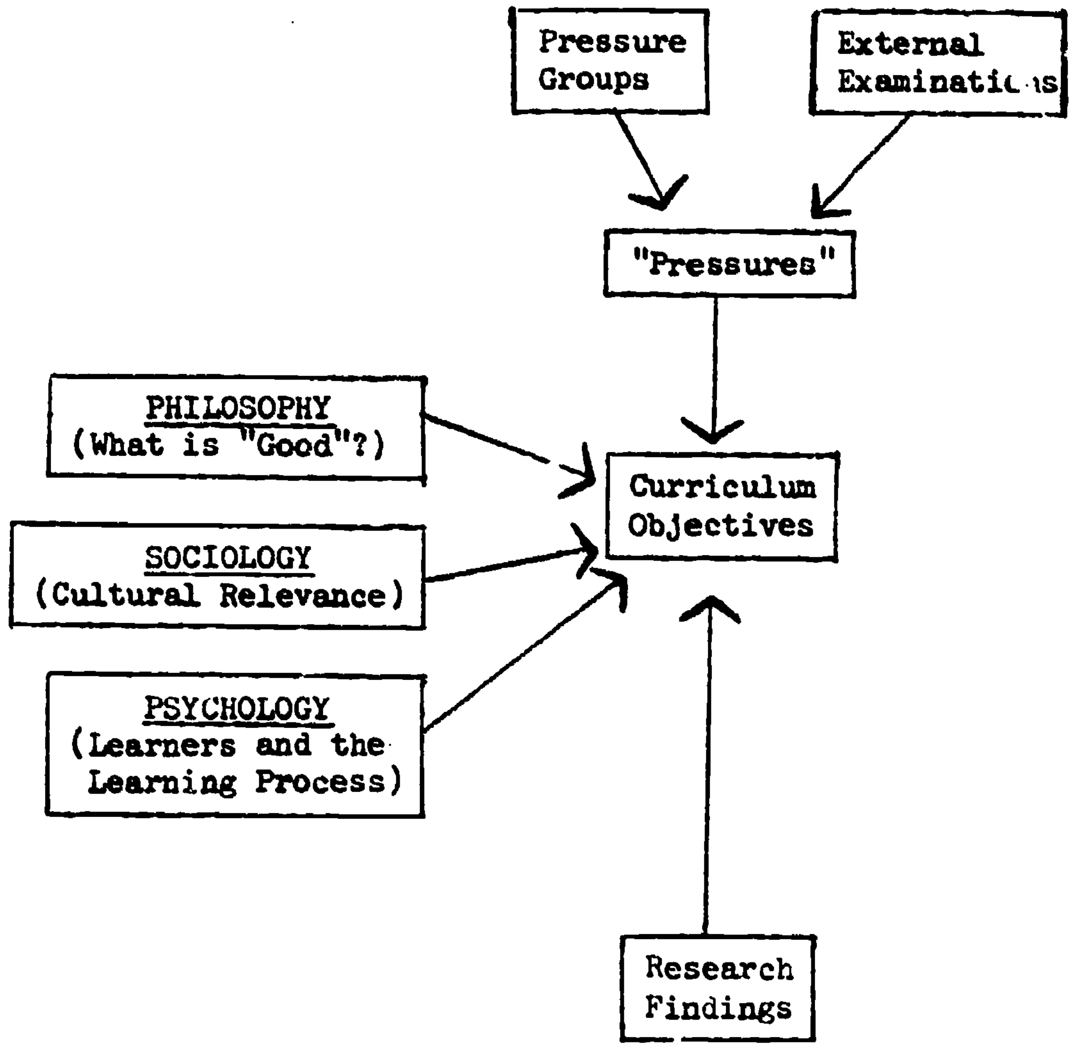

Figure 2. Oversimplified Model for Depicting Factors Contributing to Derivation of Objectives

The nature of the people involved in the decision-making processes can have an overpowing influence upon the nature of the objectives produced. For example, one of the effects of reinvolvement of scientists, especially in NSF-sponsored curriculum teams since the mid-1950's, has been to change the emphases within science teaching objectives. There is renewed interest upon having students mirror the activities of scientists. Thus, objectives are more problem-centered, with emphases

upon the development of laboratory skills such as manipulation, observation, and measurement. Concurrently, the concept of science as primarily a body of organized knowledge has been modified, and so there is considerably less emphasis upon fact retention for its own sake. Interestingly, an extensive fifty-year survey of science teachers as revealed in journal articles, published by Hurd (1954) more than twenty years ago, suggests this trend is largely in accord with teacher opinion. The survey showed the four top-ranking objectives as:

(1) scientific method of thinking;
(2) development of scientific attitudes;
(3) acquisition of factual information; and
(4) understanding major scientific principles.

Debate about the importance of using educational objectives as the prerequisite to curriculum development is subsiding. This change followed a bandwagon period in which the only "respectable" approach was the accurate <u>prespecification</u> of objectives in very precise terms. Such thinking was simply not matched by classroom realities. Whatever the theoreticians might have said, it seems probable that the beginning teacher is guided at least as much by "survival techniques" as by any purported set of educational objectives. A question of more vital interest to them, at least, is: "What activities will keep my students busy"?

(b) <u>Learning Experiences</u>

The term "learning experiences" is used to designate the activities of the learner. It thus includes the things the learner <u>does</u>, as well as the content learned and skills and attitudes developed by the learner. Obviously, the students' learning experiences will relate directly to the strategies adopted by the teacher. A vital question is: Upon what criteria should the selection of learning experiences be based?

It is true, if disconcerting, that there is no uniquely acceptable, "correct" response to the broad problem of selecting criteria. The subsequent problem of selecting the actual experiences thus becomes even more ambiguous. Some would argue that the students should select their own learning experiences according to their current interests. Others would argue, equally convincingly, that scientists are in the best situation to select learning experiences for science students, on the basis of their familiarity with the "structure" of scientific knowledge. Still others would argue that the teacher, aware of both student interests and of the broad content area of science, will be uniquely able to designate appropriate experiences. The present writer subscribes to the view that experiences should evolve from the teacher working closely with the learner, and with scientifically sound resources.

Teachers may be guided in making decisions about appropriate activities by the following criteria:

(a) taken as a whole, the experiences promote the objectives being sought;
(b) the experiences will be meaningful to the learner in the way in which they are presented;
(c) the experiences will have some longer-term benefits;
(d) the experiences are capable of interrelation in the learner's mind;
(e) the experiences have motivational value, such as being related to student interests and abilities, and/or to their possible future careers.

Bearing in mind these criteria, it becomes obvious that learning experiences selected for a curriculum need to be related to the learning context. Is the learner from a rural, industrial or urban area? In what range of out-of-school activities has the learner been engaged? Ideally, each learner would have an individual set of learning experiences, progressively molded to capitalize upon evolving interests and abilities.

In planning these learning experiences, the reservoir of possibilities is diverse. It includes:

- gathering information from printed materials for reading such as books, journals, pamphlets, and reports;
- discussions in small or large groups;
- observations of slides, movies, transparencies and other visual materials;
- listening to audiotapes;
- participation in experimental activities involving the use and manipulation of objects, equipment, and apparatus, and making observations of outcomes;
- participation in field trips, excursions, visits and tours;
- preparation and presentation of reports, talks, displays;

Such learning experiences may contribute to the development of understandings, attitudes, and skills.

Teacher strategies will greatly influence and, especially in teacher-directed classes, will largely fashion the nature of learning experiences. Thus, teachers need to be aware of and sensitive to their influences upon their students in the classroom. Increasingly, use is being made of "scientific" methods to sensitize teachers to their strategies. For example, where classroom interactions are predominantly verbal, the resulting experiences may be observed and described using one of the numerous instruments which have been developed in recent years. One of the best known is the instrument used in Flanders Interaction Analysis (1970). Flanders specified ten categories, intended to be mutually exclusive, for observing and describing what is happening in a classroom. These may be

summarized as:

Teacher Talk

1. Accepts feelings
2. Praises or encourages
3. Accepts or uses ideas of students
4. Asks questions
5. Lectures
6. Gives directions
7. Criticizes or justifies authority

Student Talk

8. Response
9. Initiation
10. Silence or confusion

Learning experiences in the predominantly verbal classroom may be described by observing and recording (at three-second intervals) which of these categories best describes what is happening at that moment.

However, such techniques are inadequate as inventories of classroom activities, for it is not only the verbal content which is important, but also how the verbal message is relayed and what non-verbal behaviors occur. Research on the variations of tone of voice and facial expressions (c.f., Rosenthal), and body language (as detected by posture and body movement) indicate that these represent indispensable supplements to verbal interactions in describing the range of learning experiences in which the learner engages. In classrooms where inquiry approaches predominate, tailor-made observational tools relating to inquiry become important additional descriptors.

(c) Organization of Learning Experiences

Just as decisions about selecting learning experiences largely relate to what is learned and through what activities, so the way in which these experiences are organized will relate to questions of "when", "for how long"

and "how do they relate to each other". In other words, the organization of learning experiences includes the interrelating and sequencing of the experiences, and making decisions about the duration of the experiences. For example, should learning about cellular structure precede or follow learning about organs of the body? Should the study of cells in plants and animals follow consecutively and be related to each other?

Should learning about the environment be part of science, geography, integrated studies, or a separate "subject"? Should it occupy one period, a block of one week, be spread over a term or a year? Curriculum committees often devote considerable time and energy (perhaps shedding more heat energy than light!) in determining a purportedly ideal sequence in which learning might take place. What appears in the written curriculum document may represent a compromise solution to reconcile differing opinions of committee members. (Indeed, it is said that a camel is a horse designed by a committee!)

Does research shed any more light upon the problem of curriculum sequence? A survey of research by White (1973) indicated that exceptions existed to all the purported "learning hierarchies" which had attempted to establish learning prerequisites. Thus, research appears to lend additional support to this writer's view that, with the probable exception of a small number of experiences in the mathematical areas, sequence is in the mind of the beholder. According to this view, each learner re-organizes things into the personally most meaningful relationships. What represents a logical sequence for the person responsible for curriculum development may appear as a random or haphazard arrangement for the learner. Likewise, a logically sequenced curriculum for one learner may appear to

another learner as a randomly sequenced curriculum.

The ideal sequence might therefore be regarded as one which is individually determined, for (preferably, in fact, by) each learner. Where the characteristic large-group teaching situation persists, students are likely to need explicit guidance in order to perceive interrelationships between successive experiences. Such guidance should help in developing a clearer understanding of the concepts being learned. Interrelations between experiences may also be promoted via integration of topics, that is, breaking down the barriers between the topics.

(d) Evaluation of Student Progress

One sees little evidence, either in school reports or in research, of attempts to evaluate the progress made by individual students on many curriculum objectivies. This is partly because of the confusion between the terms measurement and evaluation. Taken literally, evaluation means making decisions about the value of something, that is, saying how good it is. It means giving an opinion about quality. This does not necessarily involve measurement. Regretably, measurement has been accorded a superior status to other methods of describing progress, although the alternatives are more useful in many (and probably most) circumstances. This over-emphasis upon the refinement of measurement has led to the subjugation in evaluation of such important objectives as student progress in the development of scientific attitudes, problem-solving abilities, creativity, and value formation. By contrast, tests have been proliferated which relate to the easily-measurable, but educationally trival, objectives of encyclopedically-memorized knowledge. Better to measure the aspect intended in a coarse way, then to measure the wrong aspect accurately!

The message should be clear: teacher judgment based upon the best observable evidence represents an extremely important method of evaluation. These judgments may be systematized through the use of rating scales and checklists where this is seen as desirable. For example, supposing it was decided to evaluate the skill with which a student uses a microscope to examine a specimen, it is possible to draw up a list of several component skills, such as the adjustment of the light to pass through the specimen, and/or placement of the slide on the platform. Each skill may then be rated on the scale, such as on the "graphic rating scale" shown in Figure 3 below.

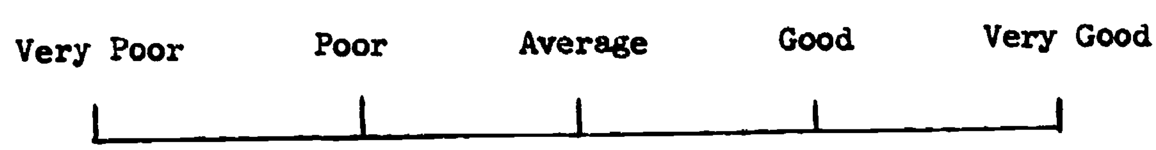

Figure 3. A Graphic Rating Scale

The rater observes the learner performing the skill and draws a cross through the line at the level judged as appropriate. Such evaluation techniques represent useful complements to written (pencil-and-paper) tests which in many cases filter out much of the available evidence. There is nothing magical about the ability of a sheaf of papers to obtain evidence - the educated teacher, as a professional person, can do this much better. Teachers need to get to know learners individually and then to have confidence in their abilities to make judgments about their students. The addition of a new range of evaluative devices, to include open-ended items (e.g., creativity tests) and performance items (e.g., in the laboratory, and the use of games and simulation devices) should substantially improve evaluation.

Ideally, student progress is evaluated in terms of the objectives

which have been designated. For example, if "ability to observe accurately" has been selected as a worthwhile objective, then evaluation procedures should seek evidence of improved accuracy in observation by students. At least three aspects of evaluation are important here, respectively "validity", "reliability", and "practicability". A valid evaluation procedure here would be to have the students actually make accurate observations, rather than the use of pencil-and-paper test items requiring descriptions about observation. Tests containing solely pencil-and-paper retention-type items have very limited validity for science education. They have low validity for objectives such as observing, measuring, and manipulation. A fuller discussion of the numerous approaches to evaluating student progress upon these objectives is beyond the scope of this curriculum monograph. A reliable evaluation procedure would be one in which various raters assigned similar ratings; and a practicable procedure would be a feasible or teacher-manageable one, preferably handled within usual school routines.

It should be noted that this discussion has been limited to evaluation of student progress (what is sometimes labelled as "assessment"), and does not consider curriculum evaluation (which is concerned with judgments related to the worthwhileness of a curriculum).

Curriculum Development

Having reviewed what were designated as four curriculum "components", the way in which these dovetail together may now be examined. One recently-promoted approach to curriculum development has been through the curriculum "project", in which a team of people work together generally in a substantial "onslaught" over a limited period of time. (Typically the period involved has been from two to four years). Usually, the project approach involves

the production, trial, modification, and publication of materials for students and/or teachers, designed to convey a particular approach to the curriculum for large numbers of students. These are typified by the "alphabet soup" curricula sponsored by the National Science Foundation, including such projects as BSCS, PSSC and CHEM Study. At the other extreme, curriculum may also be produced by an individual teacher, working virtually in isolation, for an individual learner. Between these extremes obviously lie wide ranges of possibilities in terms of the number and nature of personnel involved and in terms of the number of students for whom it is designed. Irrespective of whether the curriculum is project-developed or teacher-developed, there are certainly no recipes for curriculum development. This fact is a mixed blessing. It seems it would be easy to develop curricula if we had a set of teacher-proof infallible rules or set of dogmas. On the other hand, the implication would be that the learning process could be stripped of its human context, that the curriculum could remain the same irrespective of whom the teacher or the learner was. Such can never be the case. At the pulsating heart of the curriculum lies the decision-ridden stadium of people, with their varying sets of hopes and anxieties, joys and fears. Curricula are for people--students and teachers--interacting together. It is only by tailoring the curriculum to this context that education can become effective.

Early in this paper, a model was presented in order to simplify the discussion which followed it, and to suggest a possible approach to the development of curriculum. That sequential model (as depicted in Figure 1) implied that the development of a curriculum is a stepwise procedure which occurs in a sequence of quite separate and distinctive stages. The

sequence of stages as depicted was:

- first, the specification of objectives;
- second, the selection or development of learning experiences;
- third, the sequencing and interrelating of the learning experiences;
- fourth, the evaluation of student progress.

An extension often associated with this model incorporates a "feedback" loop; that is, the evidence derived by summing-up the student evaluations (from Stage 4) is then used to modify the objectives (i.e., Stage 1). This modification of objectives, in turn, modifies subsequent development stages, as depicted in Figure 4.

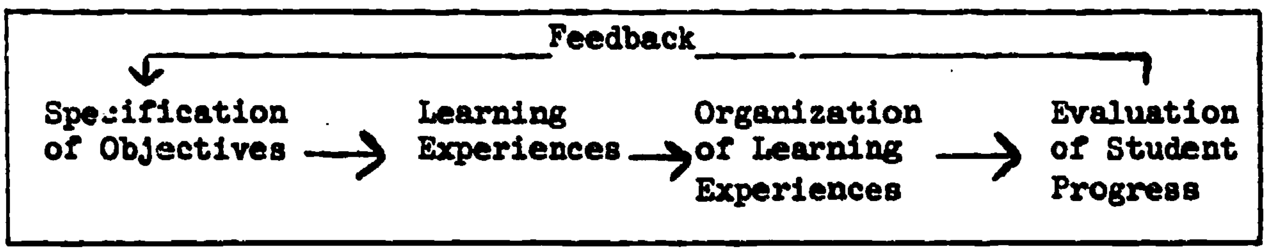

Figure 4. Sequential Model Incorporating Feedback Loop

As with the sequential model depicted in Figure 1, the model incorporating the feedback loop still suggests an oversimplification of the procedures used in curriculum development. A key weakness of this model, as discussed earlier in considering the derivation of objectives, is the role that it implies for objectives. Based upon the sequential model, one might expect that the specification of clearly-defined sets of objectives would be prerequisite to effective teaching. If this were so, the implementation of a curriculum in the classroom (involving the selection, sequencing, interrelating and evaluation of learning experiences) could not proceed according to this model unless the first stage of determining objectives had been successfully completed.

The sequential model also implies static and non-interactive curriculum elements. Such a model is not in accord with classroom reality, since each successive modification, by a teacher or the students, of objectives or activities or evaluation inevitably necessitates modifications of the other elements. A model which fails to allow for interactions and successive modifications is neither valid in terms of the realities of a school nor, therefore, especially useful. Few teachers in practice develop their objectives as a starting point for curriculum development, nor are objectives generally developed independently of decisions about the activities for students.

A model which appears to relate much more closely to reality is that depicted in Figure 5. This model recognizes that curriculum elements are both interactive and can be changed from lesson to lesson or moment to moment; that is, they are progressively modifiable. By contrast to the earlier presented models (Figure 1, 2 and 4), this model is dynamic. The dynamic model also allows for the initiation of curriculum development at any of the elements depending upon the views and feelings of the teacher and the pupil and the learning context. It is a much more accurate picture of curriculum development, as it incorporates several alternative approaches used in varying circumstances. For example, it depicts the situation in which objectives are seen as the starting point for curriculum development, the situation where the teacher goes to the classroom and starts the students off with particular activities (without necessarily relating these specifically to objectives), as well as the situation where the teacher's activities emerge from a set of expectations about the likely nature of the evaluation techniques to be used for

assessment of student progress. It is a more people-oriented model, since it allows for mind-changing at any stage, for different starting points in the curriculum process, and for differing styles of operation.

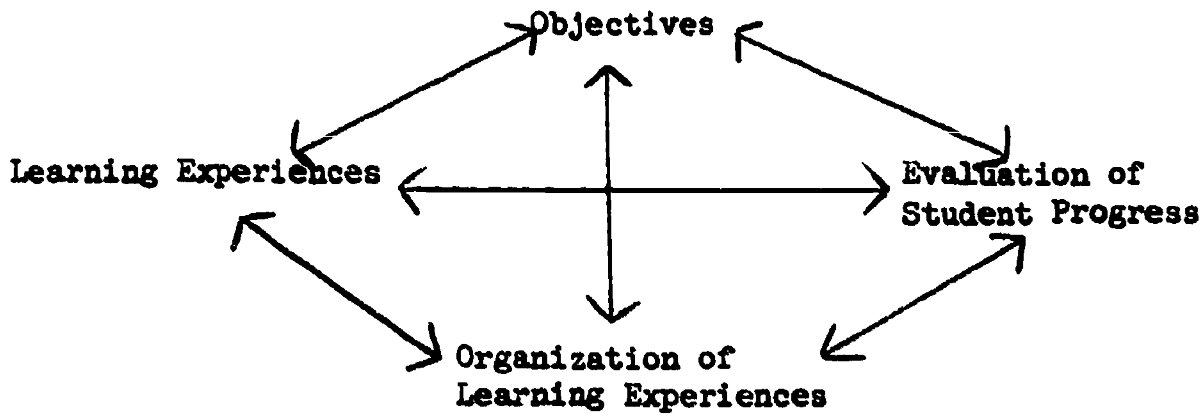

Figure 5. Dynamic Model of Curriculum

The model may be applied to the "individualized curriculum" related to each student with a unique set of characteristics, skills, abilities and attitudes. On the other hand, it may be applied to a centrally-developed curriculum for national, regional, or state implementation.

The dynamic model does not assume that objectives are prerequisite to effective classroom teaching; nor does it suggest a uniquely sequential path having only one starting point and one target in curriculum development. Rather, it suggests the tensions which exist in actual curriculum situations, with modifications to any one element having direct influences on each other element. The propitious moment or serendipitous circumstances of an unexpected or spontaneous classroom experience may cause the teacher to re-evaluate and modify objectives, selection or sequencing of activities, or evaluation procedures. As will be evident, curriculum development is not a mechanical process. No agency external to the classroom interactions between teacher and students can predetermine what will occur in the classroom. Even those curriculum projects which have

produced elaborate packages of curriculum materials have not resulted in the creation of homogeneous classrooms. To have done so may have been possible if teachers were automated and students conditioned to respond in automatic ways. Research evidence concerning curriculum implementation confirms that even where apparently identical curriculum packages or sets of project materials are used by teachers, their mode of use varies substantially (c.f., Rosenshine, 1970). This is to be expected, since different teachers, using their ingenuity and individuality, seek differing objectives, select different learning experiences, and organize them differently.

As teachers go about implementing or changing their curricula in the classroom, their practices and their needs will differ. No universal panacea or blueprint for curriculum change is feasible, nor would it be desirable for each different curriculum problem, as there will be a different solution. For each teacher with a particular curriculum problem there will be a range of curriculum alternatives representing options for solutions of the problem. For, fundamentally, curricula are for people.

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